



A Comprehensive Review on an Underutilized weed, *Digera muricata*

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Abstract: *Digera muricata*, Family: Amaranthaceae, commonly known as False Amaranth, is a pharmacologically diverse medicinal plant. Several active phytochemical constituents have been explored namely, quercetin, sitosterol, stigmaterol etc. Several studies demonstrated the exploration of pharmacological potential of various parts such as leaves, stems, roots and the plant as a whole, as an antioxidant, cytotoxic, antimicrobial, anti-diarrhoeal, and hepatoprotective. This review gives comprehensive account with special reference to phytochemistry, nutritional value, ecology and significant pharmacological importance of the plant. The literature search was carried out through different search engines viz PubMed, Science Direct etc. The data collected is assorted in terms of leaves, stem, and roots which were used for diverse investigations. The collected data suggested that the extracts from this plant may possess abundant pharmacological potential. However, the search for phytoconstituents from this plant did not provide much data which indicates towards the underutilization. Thus, there is an urgent need for further investigations to isolate and characterize pharmacologically active agents which confer medicinal properties on *Digera muricata*, as well as to elucidate the structures of these agents by which they exert their healing properties and to scientifically corroborate the existing traditional practices concerning its health benefits.

Keywords: False Amaranth, nutritional value, pharmacology, phytochemistry, wild, *Digera muricata*

INTRODUCTION

Digera muricata (L.) Mart, Family: Amaranthaceae, commonly known as False Amaranth, is a pharmacologically diverse medicinal plant.

Common name: False Amaranth

Hindi: Latmahuria, Lesua.

Marathi: Gitana, Getna.

Tamil: Toya keerai, Kaatu keerai.

Telugu: Chenchali koorra.



Kannada: Chenchali soppu, Goraji palya, Kankali soppu.

Sanskrit: Aranya, Aranyavastuka, kunanjara, kuranjara.

Geographical distribution: This weed flower is also known as false amaranth. It is widespread in eastern tropical Africa, Madagascar and tropical and subtropical Asia. In India, it is widely distributed in Rajasthan, Maharashtra and Andhra Pradesh.

Botanical description: *Digera muricata* is an annual herb, growing to 20-70 cm tall. It can be seen growing wild in waste areas. Alternately arranged leaves, 1-9 cm long and 0.2-5 cm broad, are narrowly linear to broadly ovate. [1] Flowers are borne on slender spike-like racemes, and are hairless with white colour. Fruits are sub-globose, slightly compressed and surmounted by a thick rim. Stems are hairless, simple or branched.

Nutritional values: The nutritional potential of this unexplored edible plant, *Digera muricata* commonly used as food in various parts of the world, is remarkable. The nutritive composition of stem and leaves consist of fiber which is found to be the highest (41%), followed by ash (18%), carbohydrates (13.3%), moisture (13.9%), protein (8%) and Lipid (5%). The macro minerals constitute Potassium followed by Sodium with the trace elements where Pb and Cd are present in very minute quantities. [2] Another study, through the Spectrophotometric and proximate analysis, showed significant percentage of iron in leaves and stems which was approximately 208.3 and 75.0mg/kg respectively, and the copper content was found to be 11.5mg/kg. Additionally, the plant contains vitamins namely ascorbic acid (49mg/100g), thiamine (0.10mg/100g) and β -carotene (3-30mg/100g). [3]

Ethno-botanical uses: In Ayurvedic literature, the herb is utilized as a cooling agent, as an astringent and a laxative. Boiled root infusion is provided to feeding mothers after childbirth. The whole plant is used in renal disorders in folk medicine. The flowers and seeds of the plant are used for treatment of urinary infections [4]. The whole plant is used in digestive system disorders and biliousness. The decoction of the leaves is given for treatment of kidney stones. [5] *Digera muricata* is widely used in traditional system of medicine for the treatment of diabetes mellitus. Leaves and young shoots are locally used as a vegetable, in India. In India the leaves are made into curries, or the entire plant is boiled and seasoned with salt and chilli. The flowers are rich in nectar which is sometimes sucked by children in Kenya. *Digera muricata* is most common on disturbed and waste ground, but occurs in many kinds of habitat, from dry savanna and semi-desert to moist localities on deep clay and mud soils, from sea-level up to 1500 m altitude. It also occurs as a weed in fields, sometimes being troublesome. [6]

Phytoconstituents: The primary metabolites viz. carbohydrates, proteins, lipids, etc., have been investigated in different solvent extracts of this plant. Analysis of various extracts of *Digera muricata* indicated the presence of flavonoids, alkaloids, terpenoids, saponins, coumarins, tannins, cardiac glycosides and anthraquinones as well. Rutin and Hyperoside flavonoids have been identified in hexane extract of this plant [7].

Different researchers have undertaken phytochemical investigation which revealed the presence of alkaloids, flavonoids, glycosides, tannins as the major constituents in the polar extracts. [8] In a recent study, it was confirmed that the plant is rich in phenolics through the results pertaining to GC-MS analysis of the methanolic extract of *Digera muricata*. It



led to the identification of a number of compounds. The research predicted the formula and structure of 13 different biomolecules namely Ethane 1,1-diethoxy, Phenol, 2-methoxy-4-4-(2-propenyl), 1-Hexadecanol, Cyclohexanol, 1-(2-hexynyl) Cyclopentane tridecanoic acid, methyl ester, Benzyl benzoate, Cis-13-Eicosenoic acid, Isopropyl myristate, Hexadecanoic acid, methyl ester Hexadecanoic acid, ethyl ester 9-octadecanoic acid, methyl ester, Heptadecanoic acid, 9-methyl-methyl ester, Octadecanoic acid, ethyl ester. [9]

It proved to be a potent radical scavenger and metal ion chelator in comparison to the control. It also exhibited mild immunomodulatory action. Rutin and hyperoside flavonoids have been identified in hexane extract of this plant. *Digera muricata* has explicit aromatic odor because of the existence of essential or volatile oil, which is prominently present in green leaves.

Pharmacology: An eco-friendly process utilized to produce gold nanoparticles using ethanol extract of *Digera muricata*, was evaluated in comparison to crude ethanol extract. It was deduced that gold nanoparticles revealed enhanced antibacterial activity in comparison to crude ethanol extract of *Digera muricata* against various drug-resistant strains including *Vibrio cholera*, *Staphylococcus pyrogen*, *Klebsiella* etc. [10]/ In other such experiment, a study was planned to search out nontoxic silver nanoparticles from the leaves extract of *Digera muricata* for antimicrobial action. The nanoparticles were exposed to *Escherichia coli*, *Staphylococcus aureus* and *Salmonella typhimurium*. The results further confirmed that the silver nanoparticles have promising activity against almost all the bacterial strains and can be used as an effective bactericide [11]. In another report, the extracts were subjected to the evaluation of antimicrobial activity, where the petroleum ether extract gave highest zone of inhibition at 400 µg/well against *V. cholerae*. Likewise, in fungi the ethanol extract displayed highest zone of inhibition against *Candida albicans*. [12]

The methanol extract was evaluated for the probable protective effects of *Digera muricata* against acrylamide induced hepatocellular injuries in Sprague-Dawley rat. The significant results suggested that the hepatoprotective effects could be attributed to the ample presence of phenolics and flavonoids. [13] In other research work, antioxidant and fertility effects of *Digera muricata* was studied in male rats. [14] The n-hexane extract of the plant was suggestive towards the therapeutic effects against CCl₄ induced oxidative stress and hypogonadism. The reduced level of testosterone, luteinizing hormone (LH) and follicle stimulating hormone (FSH) were restored with the n-hexane extract of *Digera muricata*. The same research group performed experiments to analyze the preventive role of CCl₄-induced oxidative damage in adrenal gland by *Digera muricata* extract in rat [15]. The results indicated that *Digera muricata* extract is able to ameliorate oxidative stress in adrenal gland induced by carbon tetrachloride in rat. The methanolic extracts were screened for free radical scavenging properties by DPPH assay, where the scavenging potential was analyzed for different solvent extracts of different polarities. The maximum activity was recorded in methanol and least activity was recorded in hexane. Antioxidant properties of methanolic extract *Digera muricata* against the CCl₄-induced toxicity in kidneys and testis had been well documented. [16] In a concurrent study, the effect of carbon tetrachloride induced DNA damages in renal cells was observed [17] where oxidative DNA damages like DNA fragmentation, were significantly reversed by methanolic fraction of *Digera muricata*. Another related work demonstrated the enhancement of GSH content in the testicular tissue of rats by *Digera*



muricata and proved the protective effects of *Digera muricata* (L.) Mart. on testis against oxidative stress of carbon tetrachloride in rat. [64] In the present study, H.P.T.L.C analysis and antioxidant [2,2- diphenyl-2-picrylhydrazyl hydrate (DPPH) assay] activity of methanolic extract of whole plant of *Digera muricata* were investigated. The methanolic

extract was obtained by soxhlation for 72 hrs. The methanolic extract showed elevated DPPH scavenging activity and had a promising activity which increased with concentration. A positive correlation was established between the level of phytoconstituents and antioxidant activities.

Crude extract of *Digera muricata* showed inhibition at all concentrations in a dose dependent manner with a nominal amount of 28.5 percentage inhibition at a concentration of 25 μ g/ml and a marked 85 percentage inhibition at a concentration of 250 μ g/ml. [18]

Another study was designed to investigate anti-urolithic activity of hydroalcoholic extract of whole herb of *Digera muricata* on experimental model of urolithiasis, by administration of ethylene glycol [19] There was a dose dependent decrease in level of stone forming agents, oxalate, calcium and phosphate in kidney as well as urine. Level of BUN, uric acid and creatinine was also found to be significantly less as compared to control group. Thus, it was concluded that hydroalcoholic extract of *Digera muricata* possess significant anti-urolithic activity at selected doses. The *in vitro* antidiabetic activity of plant leaf extracts of *Digera muricata*, was studied at five different concentrations, the plant showed dose-dependent inhibition of α -amylase enzyme with varying effect on glucose utilization. *Digera muricata* showed to have significant enzyme inhibitory activity. The anti-diabetic activity of methanolic extract of *Digera muricata* in alloxan induced diabetic rats [20] suggested that methanolic extract (200mg/kg) has potential antihyperglycemic activity in the said model.

The cardioprotective effect was observed on treatment with different concentrations of *Digera muricata* methanolic extract which prevented the elevation of serum marker enzymes creatinine kinase (CK), cardiac creatinine kinase (CK-MB), lactate dehydrogenase (LDH), aspartate transaminase (AST), alanine transaminase (ALT), alkaline phosphatase (ALP), hydrogen peroxidase (H₂O₂), total cholesterol, LDL and alterations in protein, superoxide dismutase (SOD), peroxidase (POD), catalase (CAT), glutathione (GSH), glutathione-S-transferase (GST), Glutathione peroxidase (GSHPx), γ -glutamyl transpeptidase (γ GT), HDL, creatine and urea caused by acrylamide in rats. The protective effect was further confirmed by the histological findings and was more prominent at 200 mg/kg. It was deduced that methanolic extract of *Digera muricata* offers protection against Acrylamide induced cardiac toxicity [21]. The Aqueous fraction from methanolic extract of the plant exhibited a high level of antioxidant ability, with very low IC₅₀ values. The results agreed with few previous studies where powerful antioxidant activity of polar extracts was attributed to the presence of substances with free hydroxyls. The results indicate that Aqueous fraction of methanolic extract obtained from whole plant of *Digera muricata* showed the capacity to donate hydrogen; therefore, they present DPPH scavenging activity. This activity might be due to the presence of phenolic and flavonoids constituents detected in the samples.

Cytotoxic potential of methanolic extract and its fractions were investigated against HeLa and A₅₄₉ cell lines. Crude extract of the plant was prepared in methanol by



continuous hot soxhlation technique. Crude extract was fractionated into two organic and one aqueous fraction by the help of column chromatography. 3-(4,5-dimethylthiazol-2yl)-2,4 diphenyltetrazolium bromide assay was used to evaluate the reduction of viability of the cancer cell lines. Cell viability was inhibited by crude extract of *D. muricata* in a dose dependent manner. Apoptosis assays using nucleic acid stains included propidium iodide (PI) exclusion assay and hoestch /PI assays where the results suggested that methanolic

and aqueous fraction of the extract of *D. muricata* can be utilized as a source of cytotoxic compounds [22]. The neuro-pharmacological profile was evaluated for the methanolic extract of *Digera muricata* in Swiss albino mice where different exploratory models were used. The methanolic extract produced reduction in various parameters evaluated which includes spontaneous motor activity, exploratory behavior and motor coordination. The results indicated towards a possible role as an anti-depressant with neuroleptic properties. [23]. The anti-inflammatory activity of the plant was investigated through protein denaturation assay. The methanolic extract showed a dose dependent increase in the anti-inflammatory action almost comparable to the standard drugs, Aspirin.[24]

Allelopathic potential of the plant was tested on different crops with different concentration of the extracts. It was deduced that germination of all the test species were highly affected and the decaying plant material was found to be highly phytotoxic. High quantity of allelochemicals were found to be present in roots and shoots. [25, 26]

DISCUSSION AND CONCLUSION

The current review investigated the traditional medicinal uses, biological and pharmacological potential, and nutritional analysis of the plant *Digera muricata*. The nature of data was diverse in terms of leaves, stem, fruit which is employed for included studies. The studies explored the traditional, ethnobotanical, phytochemical, economical, and pharmacological uses. The indigenous plant possesses terrific medicinal properties, attributed by a diverse group of secondary metabolites. Major constituents reported in the plant were Phenolics and Flavonoids. [27] The studies retrieved outline that whole plant can be utilized for medicinal uses [28]. Different parts of the plant were reported for its usage in traditional medicine, in the treatment and prevention of diarrhea, dysentery, colic, hepatitis, jaundice, kidney, and urinary complaints due to coughs, diabetes mellitus, antiseptic, astringent, and hemostatic, and so on. On the contrary, limited studies highlighted the allelopathic effects of the plant. The presence of numerous phytochemicals (such as alkaloids, tannins, flavonoids, and terpenes) present in active extracts, tannins, and flavonoids support the traditional claims as well as, indicated the implication of exploring some new and promising “leads.” The retrieved studies were mostly in vitro and in vivo investigations on experimental animals as well as several cell lines. [29] However, more clinical trials would be necessary to validate the traditional and biological or pharmacological properties of the selected plant. In this review, databases published in English only were considered in detail. This limitation may cause language bias. The search for some of the databases did not yield complete results due to limited availability and lesser knowledge on the functionality of the plant. Hence, it has great scope for extensive further research to curtail such limitations.



DECLARATION OF CONFLICT OF INTEREST

None

REFERENCES

Kirtikar and Basu BD; Indian medicinal plants. M/S Bishen Singh, Mahendra Pal Singh, Dehradun, India, 1975; 3: 2055.

Khan N, Sultana A, Tahir N, Jamila N. Nutritional composition, vitamins, minerals and toxic heavy metals analysis of *Trianthema portulacastrum* L., a wild edible plant from Peshawar, Khyber Pakhtunkhwa, Pakistan. African Journal of Biotechnology. 2013;12(42).

Elgailani IEH. Spectrophotometric analysis of some metals and phytochemical screening of *Digera muricata* (Leaves and stems). Pak J Pharm Sci. 2018 Sep;31(5):1923-1926.

Ghaffar A, Bui T, Rafia R, Farwa N and Muhammad I, Botanical Specifications, Chemical Composition and Pharmacological Applications of Tartara (*Digera muricata* L.) – A Review, International Journal of Chemical and Biochemical Sciences.16(2019):17-22.

Shah R, Shah SA, Shah S, Faisal S, Ullah F. Green synthesis and antibacterial activity of gold nanoparticles of *Digera muricata*. Indian Journal of Pharmaceutical Sciences. 2020 Apr 30;82(2):374-8.

Mehdi K, Rehman W, Obaid-ur-Rahman AB, Fazil S, SAJID M, RAB A, Farooq M, Haq S, Meena F. Green Synthesis of Silver Nanoparticles Using *Ajuga parviflora* Benth and *Digera muricata* Leaf Extract: Their Characterization and Antimicrobial Activity. Rev. Chim.(Bucharest). 2020;71(10):50-7.

Parrotta, J.A. Healing Plants of Peninsular India. CABI Publishing CAB International, New York, USA, 2001, 56.

Kirtikar, K.K. and Basu, B.D. Indian medicinal plants, M/S Bishen Singh, Mahendra Pal Singh, Dehradun, India, 1975, 3:2055.

Shiow, Y. Wang, Linda and Kim, S. Lewers, Min Ding. (2007). Antioxidant Activities and Anticancer Cell Proliferation Properties of Wild Strawberries, 20007, JASHS, 132(5) :647-658.

Sharma, N. and Rekha, V. A Review on *Digera muricata* (L.) Mart. A Great Versatile Medicinal Plant. International Journal of Pharmaceutical Sciences Review Research, 2013. 20(1) :114-119.

Aggarwal, S. and Narayan, R. Ecological studies of wild animal plants in a dry tropical peri-urban region of Uttar Pradesh in India. International Journal of Medicinal and Aromatic Plants, 2012, 2(2) :246-253.

Sharma, N. and Tanwer, B. Study of medicinal plants in Aravali regions of Rajasthan for treatment of Kidney stone and Urinary tract troubles. International Journal of Pharmaceutical Technology and Research, 2011, 3(1):110-113.

Shirzad, H., Taji, F, Rafeian, M. (2011). Correlation between antioxidant activity of garlic extracts and WEHI-164 fibro sarcoma tumor growth in BALB/c mice. Journal of Medicinal Food, 2011, 14(9):969-74.

Ramalashmi K. In vitro antidiabetic potential and GC-MS analysis of *Digera muricata* and *Amaranthus cruentus*. J Med Plants Stud. 2019;7(4):10-6.

Khan MR, Afzaal M, Saeed N, Shabbir M. Protective potential of methanol extract of *Digera muricata* on acrylamide induced hepatotoxicity in rats. African Journal of Biotechnology. 2011;10(42):8456-64.

Mathad P, Mety SS. Phytochemical and Antimicrobial Activity of *Digera Muricata* (L.) Mart. E-Journal of Chemistry. 2010;7(1):275-80.

Usmani S, Hussain A, Farooqui AH. Pharmacognostical and phytochemical analysis of *Digera muricata* Linn. growing as a weed in fields of Uttar Pradesh region of India. Int J. Pharm Pharm Sci. 2013;5(1):142-5.

Khan MR, Rizvi W, Khan GN, Khan RA, Shaheen S. Carbon tetrachloride-induced nephrotoxicity in rats: Protective role of *Digera muricata*. Journal of ethnopharmacology. 2009 Feb 25;122(1):91-9.

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Jagatha G, Senthilkumar N. Evaluation of anti-diabetic activity of methanol extract of *Digera muricata* (L.) Mart in alloxan induced diabetic rats. International journal of pharmaceutical sciences and research. 2011 Jun 1;2(6):748-52.

Usmani S., Hussain A. and Farooqui A. H. A. Determination of phytochemicals, phytochemical screening and evaluation of antioxidant potential of *Digera muricata*, Der Pharmacia Lettre, 2013, 5 (2): 3-4.



Usmani S, Hussain A, Farooqui AH, Arshad M, Siddiqui S, Ahmad M, Wahab S. Anti-proliferative Activity of Crude Extract and Fractions Obtained from *Digera muricata* on HeLa Cell Lines of Human Cervix and A 549 Cell Lines of Human Lung. *Pharmacognosy Journal*. 2014 Nov 1;6(6).

Balaji S. R, Jaikumar S, Sekkizhar M. In-vitro Anti-Inflammatory activity of *Digera muricata* Extracts. *International Journal of Research in Pharmaceutical Sciences*, 2020, 11(4), 5748-5751.

Aziz S, Shaukat SS. Allelopathic potential of *Digera muricata*, a desert summer annual. *Pakistan Journal of Botany*. 2014 Mar 15;46(2):433-9.

Adnan M, Ullah I, Tariq A, Murad W, Azizullah A, Khan AL, Ali N. Ethnomedicine use in the war affected region of northwest Pakistan. *Journal of Ethnobiology and Ethnomedicine*. 2014 Dec;10(1):1-6.

Jansen PC. *Trianthema portulacastrum* L.[Internet] Record from PROTA4U. Grubben GJH, Denton OA. PROTA (Plant Resources of Tropical Africa/Ressources végétales de l'Afrique tropicale). Wageningen, Netherlands.

Seshadri S, Nambiar VS. Kanjero (*Digera arvensis*) and drumstick leaves (*Moringa oleifera*): nutrient profile and potential for human consumption. *World review of nutrition and dietetics*. 2003 Jan 1;91:41-59.

Polhill RM, Nordal I, Kativu S, Poulsen AD. *Flora of tropical east Africa*. CRC Press; 2020 Dec 17.

Usmani S, Hussain A, Farooqui A. Pharmacognostical and phytochemical analysis of *Digera muricata* L. Growing as a weed in fields of Uttar Pradesh region of India. *Int J Pharm Sci*. 2013; 5(1):142-145.